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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/544,156	08/01/2005	Hisashi Kojima	5259-000057/US/NP	8458

27572 7590 04/26/2011
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ART UNIT	PAPER NUMBER
2466	

MAIL DATE	DELIVERY MODE
04/26/2011	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/544,156	KOJIMA ET AL.	
	Examiner	Art Unit	
	Christopher Crutchfield	2466	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *02 March 2011*.

2a)☐ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1,5,6,12,16,18 and 19* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1, 5, 6, 12, 16, 18 and 19* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☐ Information Disclosure Statement(s) (PTO/SB/08)
Paper No(s)/Mail Date _____.

4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____.

5) ☐ Notice of Informal Patent Application

6) ☐ Other: _____.

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 2 March 2011 has been entered.

Claim Rejections - 35 USC § 103

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

3. The factual inquiries set forth in *Graham* **v.** *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

> 1. Determining the scope and contents of the prior art.
> 2. Ascertaining the differences between the prior art and the claims at issue.
> 3. Resolving the level of ordinary skill in the pertinent art.
> 4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

4. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various

claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

5. **Claims 1, 16, 18 and 19** are rejected under 35 U.S.C. 103(a) as being unpatentable over X*u*, et al. (Y. Xu, A. Basu and Y. Xue, IETF Draft, June 2002, A BGP/GMPLS Solution for Inter-Domain Optical Networking) in view of *Ould-Brahim*, et al. (H. Ould-Brahim, Y. Rekhter, D. Fedyk, E. Rosen, E. Mannie, L. Fang, J. Drake, Y. Xue, R. Hartani and D. Papadimitrio, BGP/GMPLS Optical/TDM VPNs, IETF Draft, November 2001, Pages 1-18), *Rajagoplan,* et al. (B. Rajagoplan, J. Liciani, D. Aduche, B. Cain, B. Jamoussi and D. Saha, IP over Optical Networks: A Framework – Second Draft Version, 6 June 2002, Internet Engineering Task Force, Pages 1-41) and *Kompella*, et al. (K. Kompella, J. Drake, G. Bernstein, D. Fedyk, E. Mannie, D. Saha, and V. Sharma, OSPF Extensions in Support of Generalized MPLS, Network Working Group- Internet draft: draft-kompella-ospf-gmpls-extensions-02, July 2001, Pages 1-9).

Regarding Claim 1, X*u* discloses an optical network comprising:

a. Sections for establishing optical paths using Resource reSerVation Protocol-Traffic Engineering (RSVP-TE) as a signaling protocol, for Generalized Multi- Protocol Label Switching (GMPLS) (Page 5, Figure 1, Connection between X1 and X2 and Page 20, Section 8.1.1). (The system of *Xu* discloses an optical network wherein X1 and X2 are Optical Cross Connects [OXCs] and establish optical paths [Page 5, "X1, X2, X3,…are

Optical Cross Connects (OXCs)]. *Xu* further discloses that RSVP-TE may be used in the provider network in order to signal the establishment of intra-domain paths [Page 20, Section 8.1.1].)

b. A plurality of optical edge routers (Figure 1, A2 and B2) for connecting external IP networks (Figure 1, Client B and Client A) to the optical network (See Page 4 – the Provider networks are optical GMPLS networks).

c. A plurality of optical cross connects, (Page 5, Figure 1, X1 and X2) for connecting the optical edge routers by the optical paths, (Page 5, Figure 1, Connections between X1 and Y2) having switching sections (Page 5, the Optical Cross Connects switch the paths) with respect to an optical path unit (It is officially noted that in an optical network, their must be an optical path unit to generate an optical signal, therefore the optical cross connects switch the optical paths with respect to an optical path unit).

d. Wherein each of the optical edge routers has an a IP network instance for maintaining a routing table in each of the external IP networks and activating routing protocols between the external IP networks and the IP network instance (Routers A2, A3, A5 and A7 Maintain Standard IP routing tables which determine the routes to the layer 3 neighbors [Page 8, Section 6.1]. The routes may be those of the external IP neighbors learned via an IGP/EGP [Page 8, Section 6.1][i.e. For example, looking to Fig. 1 the route to A1 learned by A2 via an IGP/EGP].)

e. Wherein *each optical ingress router* has an optical network control instance for maintaining topology information in the optical network and switching/signaling the optical paths based on at least one of the topology and routing information for the external IP networks learned from the activated routing protocols (Figure 1, Connection between A2 and A7 and Page 7, Numbers 7-9). (X1, X2, Y1 and Y2 are Optical Cross Connects [OXCs] and establish and switch optical paths connecting the edge routers [i.e. X1 and Y2] [Page 5, Figure 1, Connection between X1 and Y2 and Page 5, "X1, X2, X3,...are Optical Cross Connects (OXCs)]. Intra domain link status information is disseminated using an IGP and stored in all border network entities (BNEs) and non BNEs [Page 9, "In provider networks, both...." to end of page]. Therefore, topology information [including, at a minimum, fiber optic link status] concerning the internal links of the [including the optic links of the network] is exchanged via an IGP and stored by the border network entity (BNE)/edge router control instance. The BNE/Edge router further uses the routing information gained via the IP network instance in the external network [See (d), Supra] to control routing through the optical network by allowing the system to specify the source and destination of the optical circuit connection to devices in the external IP network [Pages 8-9, Section 6.1.4] [For Example A5 may know the route to the router A1, in the external network, is carried via an optical route terminating at A2 - See [Pages 8-9, Section 6.1.4]. Therefore the optical ingress router, which establishes the optical connection upon request of the BNE/optical edge router, establishes the optical path based on the information learned from the IP network instance's activated routing protocol.)

g. Wherein BGP protocols are used for protocols for exchanging the route information of the external IP networks (Page 6). (The ingress edge router may use BGP to learn routes to conventional IP peers, such as the external IP networks [Page 8, Section 6.1.1].)

h. Wherein the optical paths are wavelength paths (Pages 13-14). (The path type may be a lambda [i.e. wavelength] path [Page 14, Encoding type "Lambda"].)

i. Wherein the optical network control instances are provided so as to be used by all the external IP networks *in the provider network* (Page 6, Section 4.1, Numbers 2 and 5 and Pages 16-17, Section 7.4). (The optical network control instances in the BNE/optical edge routers within a single provider IGP domain exchange all CAG information for all client networks among themselves, regardless of attachment to the client network [Pages 17-18, Section 7.6]. Therefore, the optical network control instance is used by all the external IP networks.)

j. Wherein the IP network instances corresponding to all the external IP networks are provided independent of each other (Page 6, Section 4.1, Number 5 and Pages 16-17, Section 7.4). (The IP network instances are "provided independent of each other", as the IP network control instances only receive routes to external IP network from the other IP network Instances if they are members of the same client network [Page 6, Section 4.1, Number 5 and Pages 16-17, Section 7.4 - Showing that "client B" will not receive information from client A's IP network instances] [See also Applicant's Specification, Pages 30-31 - showing that what is meant by an "independent" IP network instance is

that each instance is independent of other instances associated with another client networks, as it does not exchange routing information with the other client networks].)

Xu fails to disclose the system comprises a single provider network such that the optical network control instances are provided so as to be used by all the external IP networks. (i.e. The system of *Xu* discloses the provisioning of GMPLS VPNs in a situation with multiple provider networks. The use of multiple provider networkers breaks up the common exchange of all CAG information among the edge routers, as the provider-to-provider link does not allow the dissemination of the CAG information via a single provider IGP to all edge routers [See Page 6, Section 4.1 Number 4 - The CAP info may be filtered at the provider edge based on service agreements]. The system of *Ould-Brahim* is provided to cure this deficiency by showing that it was known in the art that GMPLS systems with a single provider network could be constructed so as to allow the collapse into a single common provider VPN the example of Fig. 1 of *Xu* such so as to form a contiguous IGP domain allowing the common use and exchange of IGP information among the optical network control instances.) In the same field of endeavor, *Ould-Brahim* discloses the use of a common provide network to link multiple customer VPN sites (See pages 3-4, Section 4).

Therefore, since *Ould-Brahim* suggests the use of a common provider network for performing VPN connections, it would have been obvious to a person of ordinary skill in the art at the time of the invention to collapse the provider network of *Xu* into a single provider domain and to then use the IGP protocol in the optical domain to allow the common use and exchange of IGP information among the optical network control instances. The motive to combine is to allow the techniques of *Xu* to be used to perform VPN networking among multiple clients in a single provider domain.

Xu fails to disclose an optical network further comprising sections for establishing optical paths using OSPF as a routing protocol and an optical network edge router having both an IP network instance and an optical network control instance. In the same field of endeavor, *Rajagoplan* discloses an optical network further comprising sections for establishing optical paths using OSPF as a routing protocol and RSVP-TS as a signaling protocol for GMPLS (Page 15, Section 6, Pages 13-14, Section 5.2, Page 9, Figure 1 and Pages 15-16, Section 6.1.1). (The system of *Rajagoplan* discloses that the optical network may be controlled by using OSPF signaling [Pages 16-17, Section 6.2.1]. *Rajagoplan* further discloses that if the optical edge router of the customer edge network is trusted, the optical edge router may receive interior routing information from the optical network and may also signal explicit routes through the network [Page 15, Section 6, Pages 13-14, Section 5.2]. It is further inherent that the received information concerning the interior state of the optical network is stored, as it is used for explicit route determination at the edge nodes. Finally, *Rajagoplan* discloses that OSPF Opaque-LSAs, with the appropriate extensions, may be used to distribute topology information, including topology state information and that RSVP-TE may be used to establish paths within the network [Pages 15-16, Section 6.1.1].)

Therefore, since *Rajagoplan* suggests a combined IP router using OSPF and RSVP-TE, it would have been obvious to a person of ordinary skill in the art at the time of the invention to implement combined IP and optical signaling into as taught by *Rajagoplan* into the teachings of *Xu*. Combined IP and optical signaling into as taught by *Rajagoplan* can be implemented into the system of *Xu* by moving the optical network control instance from the optical ingress router to the optical edge router as taught by *Rajagoplan* and establishing paths using RSVP-TE while using OSPF-TE for the distribution of topology information. The motive to combine is provided by *Rajagoplan* is to allow the IP network to use explicit route signaling if the IP network is

trusted, while using common and well known protocols to discover and establish routes through the network (Page 15, Section 6, Pages 13-14, Section 5).

Xu fails to disclose an optical network further comprising sections for establishing optical paths using OSPF-TE as a routing protocol. In the same field of endeavor, *Kompella* discloses an optical network further comprising sections for establishing optical paths using OSPF-TE as a routing protocol (Page 3, Abstract and Pages 5). (The system of *Kompella* discloses the use of OSPF-TE in a GMPLS network in order to transmit traffic load information within the network.)

Therefore, since *Kompella* discloses the use of OSPF-TE in a GMPLS network, it would have been obvious to a person of ordinary skill in the art at the time of the invention to combine the OSPF-TE routing protocol of *Kompella* with the system of *Xu* by replacing the OSPF protocol of *Xu* as modified by *Rajagoplan* with OSPF-TE to allow the system to transmit extended LSAs with traffic engineering information in the network. The motive to combine is provided by *Kompella* and is to allow the OSPF routing protocol to carry extended information that enables the use of traffic engineering to improve network utilization and robustness (See Pages 3-4).

Regarding claim 16, *Xu* discloses an information transmission network system:

a. Having a plurality of line exchangers (Figure 1, X1-X4, Page 5, "...X1-X5...are optical cross connects) and a plurality of packet exchangers, for setting communication lines among the packet exchangers, (Figure 1, A2, B2, A3, A5, A7) the line exchangers and the packet exchangers being connected by communication lines, (Figure 1, Connection between A2 and X1) wherein, the line exchangers have a line switch and a section for controlling line paths and wherein the line switch has a function for connecting the

communication lines, connected to the line exchangers based on the topology of the communication lines among the packet exchangers (Pages 8-9, Section 6.1.4). (The BNE/packet exchanger obtain information on external IP routes using a routing protocol [i.e. routing information concerning the topology of the communication lines among the edge IP router/packet exchanger and a non-edge IP router/packet exchanger in an external network] [Page 8, Section 6.1 - For example, looking to Fig. 1 the route to A1 learned by A2 via an IGP/EGP]. The packet exchanger/BNE further uses the routing information gained via the IP network instance in the external network to control routing through the optical network by allowing the system to specify the source and destination of the optical circuit connection to devices in the external IP network [Pages 8-9, Section 6.1.4] [For Example A5 may know the route to the router A1, in the external network, is carried via an optical route terminating at A2 - See [Pages 8-9, Section 6.1.4]. Therefore the OXC/line exchanger, which establishes the optical connection upon request of the BNE/packet exchanger, establishes the optical path based on routes/topologies to external IP routers/packet exchangers learned by the packet exchanger.)

b. Wherein each of the packet exchangers (Figure 1, Element A2) connected to the line exchangers (Figure 1, Element X5), has a packet switch and a section for controlling packet paths and the packet switch has functions for selecting communication lines for transmission and outputting in accordance with packet-ingress-side's information transmitted via the communication lines and the section for controlling packet paths acknowledges connection-related-information with respect to packet exchange among the packet exchangers connected via the communication lines, by exchanging the information for the packet paths via the communication lines, and determines the

communication lines for output in accordance with the packet-ingress-side's information (Pages 4-7). (Routers A2, A3, A5 and A7 Maintain Standard IP routing tables which determine the routes to the layer 3 neighbors [Page 7, Section 6.1]. These routes are distributed via BGP instances maintained at each IP router via the communication lines [Page 5].)

c. Wherein the communication lines are MPLS-LSP lines (Page 3, Section 3). (The communications lines used in the system of *Xu* may comprise underlying MPLS-LSP paths [Section 3].)

Xu further discloses that a separate *optical ingress router* has a section for controlling line paths, (Pages 7 and 9, The ingress edge router/BNE controls the establishment of label switched paths, and therefore the line paths) and a cooperative control section (Pages 7 and 9, The IP egress edge router of the client network contacts the ingress edge router in the provider network via BGP to initiate a label switched path) wherein:

a. The section for controlling line paths has functions for transmitting messages to the line exchangers to set up lines in accordance with the instructed paths so that the line exchangers, receiving the messages for controlling and setting the connected lines, set up the communication lines, and sending control messages to the line exchangers for setting the lines in accordance with the instructed paths (Page 7, Point 8, The ingress BGP speaker decides the next hop BGP speaker and initiates intra domain label switch path creation).

b. The sections for controlling line paths in the *optical ingress router* are connected to at least the sections for controlling line paths in the line exchangers via lines among the packet exchangers and the line exchangers (Pages 6 and 7 - The optical ingress router/provider edge router controls the optical cross connects via the control plane and the section for controlling line paths.)

c. The sections for controlling line paths in the line exchangers and the sections for controlling line paths in the *optical ingress router* have a functions for acknowledging line connection conditions in a line-exchanging-network, by exchanging information of the communication conditions among the communication lines (Page 9, "In provider networks, both…." to end of page). (Intra domain link status information is disseminated using an IGP and stored in all border network entities (BNEs) and non BNEs [Page 9, "In provider networks, both…." to end of page]. Therefore, topology information [including, at a minimum, fiber optic link status] concerning the internal links [including the optic links] is exchanged via an IGP and stored by the border network entity (BNE)/edge router control instance. Finally, upon demand, a path for carrying packets between Client A, Location 1 and Client A, Location 2, is created when the ingress BGP speaker/edge router feeds a signal that establishes the route to the intra-domain routing process [Figure 1, Connection between A2 and A7 and Page 7, Numbers 7-9]. The path may be set up/torn down on demand [Page 8, Numeral 2].)

d. A cooperative control section that has a function for receiving instructions regarding new communication lines, referring to two pieces of information, connection information, with respect to line-exchanging-network, collected by the *optical ingress router*, and

connection information with respect to packet-exchange collected by the section for controlling packet paths. (The provider ingress edge router has an intra-domain routing process that creates the intra domain label switched path based on the interior optical network information [Page 7, Section 8] and the egress edge IP address [Page 7, Section 8]. Therefore, it is inherent that the instruction to create such a path must include the connection information of the line exchange and the packet path information.)

Xu fails to disclose that the system comprises a single provider network such that the information exchange occurs between all of the optical ingress routers. (i.e. The system of *Xu* discloses the provisioning of GMPLS VPNs in a situation with multiple provider networks. The use of multiple provider networkers breaks up the common exchange of all CAG information among the edge routers, as the provider-to-provider link does not allow the dissemination of the CAG information via a single provider IGP to all edge routers [See Page 6, Section 4.1 Number 4 - The CAP info may be filtered at the provider edge based on service agreements]. The system of *Ould-Brahim* is provided to cure this deficiency by showing that it was known in the art that GMPLS systems with a single provider network could be constructed so as to allow the collapse into a single common provider VPN the example of Fig. 1 of *Xu* such so as to form a contiguous IGP domain allowing the common use and exchange of IGP information among the optical network control instances.) In the same field of endeavor, *Ould-Brahim* discloses that the system comprises a single provider network such that the information exchange occurs between all of the optical ingress routers (See pages 3-4, Section 4).

Therefore, since *Ould-Brahim* suggests the use of a common provider network for performing VPN connections, it would have been obvious to a person of ordinary skill in the art at the time of the invention to collapse the provider network of *Xu* into a single provider domain

and to then use the IGP protocol in the optical domain to allow the common use and exchange of IGP information among the optical network control instances. The motive to combine is to allow the techniques of *Xu* to be used to perform VPN networking among multiple clients in a single provider domain.

Xu fails to disclose each of the *packet exchangers*, connected to the line exchangers, has a section for controlling line paths, and a cooperative control section wherein the section for controlling line paths has functions for transmitting messages to the line exchangers to set up lines in accordance with the instructed paths so that the line exchangers, receiving the messages for controlling and setting the connected lines, set up the communication lines, and sending control messages to the line exchangers for setting the lines in accordance with the instructed paths, the sections for controlling line paths in the packet exchangers are connected to at least the sections for controlling line paths in the line exchangers via lines among the packet exchangers and the line exchangers the sections for controlling line paths in the line exchangers and the sections for controlling line paths in the packet exchangers have a functions for acknowledging line connection conditions in a line-exchanging-network network, by exchanging information of the communication conditions among the communication lines and a cooperative control section that sections select paths, being used for the new communication lines, and instructing the section for controlling line paths to set paths being used for the new communication lines wherein Open Shortest Path First-Traffic Engineering (OSPF) is used as a communication protocol for the communication lines. In the same field of endeavor, *Rajagoplan* discloses each of the packet exchangers, connected to the line exchangers, has a section for controlling line paths, and a cooperative control section wherein the section for controlling line paths has functions for transmitting messages to the line exchangers to set up lines in accordance with the instructed paths so that the line exchangers, receiving the messages for

controlling and setting the connected lines, set up the communication lines, and sending control messages to the line exchangers for setting the lines in accordance with the instructed paths, the sections for controlling line paths in the packet exchangers are connected to at least the sections for controlling line paths in the line exchangers via lines among the packet exchangers and the line exchangers the sections for controlling line paths in the line exchangers and the sections for controlling line paths in the packet exchangers have a functions for acknowledging line connection conditions in a line-exchanging-network network, by exchanging information of the communication conditions among the communication lines wherein Open Shortest Path First-Traffic Engineering (OSPF) is used as a communication protocol for the communication lines (Page 15, Section 6, Pages 13-14, Section 5.2 and Page 9, Figure 1). (If the exterior IP domain is trusted, the edge routers can receive interior routing and link state information from the optical network and may also signal explicit routes through the network via the control domain [Page 15, Section 6, Pages 13-14, Section 5.2]. It is further inherent that the received information concerning the interior state of the optical network is stored, as it is used for explicit route determination at the edge nodes. Finally it is inherent that there exists cooperative control between the IP [i.e. packet exchanger] and MPLS [i.e. path controller] signaling to establish the routes, as the routes are established responsive to demands to access remote IP networks, but are implemented using MPLS label switch establishment commands [Page 15-20, Section 6 and Pages 13-14, Section 5.2]. Finally, *Rajagoplan* discloses that OSPF Opaque-LSAs, with the appropriate extensions, may be used to distribute topology information, including topology state information and that RSVP-TE may be used to establish paths within the network [Pages 15-16, Section 6.1.1].)

Therefore, since *Rajagoplan* suggests a combined IP router utilizing OSPF, it would have been obvious to a person of ordinary skill in the art at the time of the invention to

implement combined IP and optical signaling into as taught by *Rajagoplan* into the teachings of *Xu*. Combined IP and optical signaling into as taught by *Rajagoplan* can be implemented into the system of *Xu* by moving the optical network control instance from the optical ingress router to the optical edge router as taught by *Rajagoplan* and implementing cooperative IP and MPLS control of routing in the separated packet and control units of *Xu* by means of BGP signaling and OSPF. The motive to combine is provided by *Rajagoplan* and is to allow the IP network to use explicit route signaling if the opposing MPLS network is trusted (Page 15, Section 6, Pages 13-14, Section 5).

Xu fails to disclose an optical network further comprising sections for establishing optical paths using OSPF-TE as a routing protocol. In the same field of endeavor, *Kompella* discloses an optical network further comprising sections for establishing optical paths using OSPF-TE as a routing protocol (Page 3, Abstract and Pages 5). (The system of *Kompella* discloses the use of OSPF-TE in a GMPLS network in order to transmit traffic load information within the network.)

Therefore, since *Kompella* discloses the use of OSPF-TE in a GMPLS network, it would have been obvious to a person of ordinary skill in the art at the time of the invention to combine the OSPF-TE routing protocol of *Kompella* with the system of *Xu* by replacing the OSPF protocol of *Xu* as modified by *Rajagoplan* with OSPF-TE to allow the system to transmit extended LSAs with traffic engineering information in the network. The motive to combine is provided by *Kompella* and is to allow the OSPF routing protocol to carry extended information that enables the use of traffic engineering to improve network utilization and robustness (See Pages 3-4).

X*u* fails to disclose an information transmission network system for setting the communication lines among the packet exchangers and packet/line exchangers, having packet/line exchangers in which the packet exchangers and the line exchangers are integrated.

However, it is officially noted that the the integration of a packet exchanger and a line exchanger was well known in the pertinent art at the time of the invention. Thus it would have been obvious to a person of ordinary skill in the pertinent art at the time of the invention to integrate the packet exchanger and the edge line exchanger of X*u*, et al. The packet exchanger (Figure 1, A2, B2, A3, A5, A7) and the edge line exchanger of X*u*, et al. (Figure 1, X1, X3, and Y2) can be combined by including both in the same device and maintaining the connection between each internally. The motive to combine the packet exchanger and the edge line exchanger of X*u*, et al. is to allow for an integrated device that is smaller and cheaper to produce.

Regarding claim 18, *Xu* discloses a packet exchanger (Figure 1, Element A2 and Page 4) in an information transmission network system, having a plurality of line exchangers and, comprising a packet switch (Figure 1, Element A2) having a function for selecting communication lines used for transmittance, in accordance with packet-ingress-side's information transmitted by the communication lines and outputting (Pages 4-7). (Routers A2, A3, A5 and A7 Maintain Standard IP routing tables which determine the routes to the layer 3 neighbors [Page 7, Section 6.1]. These routes are distributed via BGP instances maintained at each IP router via the communication lines [Page 5].)

Xu further discloses a plurality of *optical ingress routers* (Figure 1, Elements X1 and X2), for setting communication lines among the packet exchangers (Page 7, Section 8) comprising:

a. A section for controlling packet paths having functions for acknowledging connection-related-information with respect to packet exchange by exchanging information of the packet paths via the communication lines among the packet exchangers connected via the communication lines, and determining the communication lines for output (Page 7,

Point 8, The ingress BAP speaker decides the next hop BGP speaker and initiates intra domain label switch path creation).

b. At least one section for controlling line paths in the line exchangers, connected to the communication lines among the packet exchangers/line exchangers, (Figure 1, Connection between X1 and X5) for exchanging connection information of the communication lines and acknowledging line connection condition in a communication network (Page 9, “In provider networks, both....” to end of page) based on the topology of the communication lines among the packet exchangers (Pages 8-9, Section 6.1.4). (The BNE/packet exchanger obtain information on external IP routes using a routing protocol [i.e. routing information concerning the topology of the communication lines among the edge IP router/packet exchanger and a non-edge IP router/packet exchanger in an external network] [Page 8, Section 6.1 - For example, looking to Fig. 1 the route to A1 learned by A2 via an IGP/EGP]. The packet exchanger/BNE further uses the routing information gained via the IP network instance in the external network to control routing through the optical network by allowing the system to specify the source and destination of the optical circuit connection to devices in the external IP network [Pages 8-9, Section 6.1.4] [For Example A5 may know the route to the router A1, in the external network, is carried via an optical route terminating at A2 - See [Pages 8-9, Section 6.1.4]. Therefore the OXC/line exchanger, which establishes the optical connection upon request of the BNE/packet exchanger, establishes the optical path based on routes/topologies to external IP routers/packet exchangers learned by the packet exchanger.)

c. A cooperative control section having a function for receiving instructions by new communication lines, referring to two pieces of information, connection information, with respect to the packet exchange, collected by the section for controlling line paths, (i.e. information received via IGPs) and connection information with respect to the packet exchange collected by the section for controlling packet paths, (i.e the BGP request from the packet router identifying the egress IP sought to be connected) selecting paths used for the new communication lines, and instructing the section for controlling line paths to set paths used for the new communication lines (Pages 7-8). (The provider ingress edge router has an intra-domain routing process that creates the intra domain label switched path based on the interior optical network information [Page 7, Section 8] and the egress edge IP address [Page 7, Section 8]. Therefore, it is inherent that the instruction to create such a path must include the connection information of the line exchange and the packet path information.)

d. Wherein the section for controlling line paths have functions for transmitting messages to the line exchangers to set up lines in accordance with the instructed paths so that the line exchangers receive the messages for controlling and setting the connected lines, set up the communication lines, and send control messages to the line exchangers for setting the lines in accordance with the instructed paths (Page 7, Section 8 – See (b), Supra). (Intra domain link status information is disseminated using an IGP and stored in all border network entities (BNEs) and non BNEs [Page 9, "In provider networks, both…." to end of page]. Therefore, topology information [including, at a minimum, fiber optic link status] concerning the internal links [including the optic links] is exchanged via an IGP and stored by the border network entity (BNE)/edge router control instance.

Finally, upon demand, a path for carrying packets between Client A, Location 1 and Client A, Location 2, is created when the ingress BGP speaker/edge router feeds a signal that establishes the route to the intra-domain routing process [Figure 1, Connection between A2 and A7 and Page 7, Numbers 7-9]. The path may be set up/torn down on demand [Page 8, Numeral 2].)

e. Wherein the communication lines are MPLS-LSP lines (Page 3, Section 3). (The communications lines used in the system of *Xu* may comprise underlying MPLS-LSP paths [Section 3].)

Xu fails to disclose that the system comprises a single provider network such that the information exchange occurs between all of the optical ingress routers. (i.e. The system of *Xu* discloses the provisioning of GMPLS VPNs in a situation with multiple provider networks. The use of multiple provider networkers breaks up the common exchange of all CAG information among the edge routers, as the provider-to-provider link does not allow the dissemination of the CAG information via a single provider IGP to all edge routers [See Page 6, Section 4.1 Number 4 - The CAP info may be filtered at the provider edge based on service agreements]. The system of *Ould-Brahim* is provided to cure this deficiency by showing that it was known in the art that GMPLS systems with a single provider network could be constructed so as to allow the collapse into a single common provider VPN the example of Fig. 1 of *Xu* such so as to form a contiguous IGP domain allowing the common use and exchange of IGP information among the optical network control instances.) In the same field of endeavor, *Ould-Brahim* discloses that the system comprises a single provider network such that the information exchange occurs between all of the optical ingress routers (See pages 3-4, Section 4).

Therefore, since *Ould-Brahim* suggests the use of a common provider network for performing VPN connections, it would have been obvious to a person of ordinary skill in the art at the time of the invention to collapse the provider network of *Xu* into a single provider domain and to then use the IGP protocol in the optical domain to allow the common use and exchange of IGP information among the optical network control instances. The motive to combine is to allow the techniques of *Xu* to be used to perform VPN networking among multiple clients in a single provider domain.

Xu fails to disclose a plurality of *packet exchangers* for setting communication lines among the packet exchangers comprising a section for controlling packet paths having functions for acknowledging connection-related-information with respect to packet exchange by exchanging information of the packet paths via the communication lines among the packet exchangers connected via the communication lines, and determining the communication lines for output, at least one section for controlling line paths in the line exchangers, connected to the communication lines among the packet exchangers/line exchangers, for exchanging connection information of the communication lines and acknowledging line connection condition in a communication network based on a topology of the communication lines among the packet exchangers wherein the section for controlling line paths have functions for transmitting messages to the line exchangers to set up lines in accordance with the instructed paths so that the line exchangers receive the messages for controlling and setting the connected lines, set up the communication lines, and send control messages to the line exchangers for setting the lines in accordance with the instructed paths and a cooperative control section having a function for receiving instructions by new communication lines, referring to two pieces of information, connection information, with respect to the packet exchange, collected by the section for controlling line paths, and connection information with respect to the packet exchange collected

by the section for controlling packet paths, selecting paths used for the new communication lines, and instructing the section for controlling line paths to set paths used for the new communication lines wherein Open Shortest Path First-Traffic Engineering (OSPF) is used as a communication protocol for the communication lines. In the same field of endeavor, *Rajagoplan* discloses *packet exchangers* for setting communication lines among the packet exchangers comprising a section for controlling packet paths having functions for acknowledging connection-related-information with respect to packet exchange by exchanging information of the packet paths via the communication lines among the packet exchangers connected via the communication lines, and determining the communication lines for output, at least one section for controlling line paths in the line exchangers, connected to the communication lines among the packet exchangers/line exchangers, for exchanging connection information of the communication lines and acknowledging line connection condition in a communication network based on a topology of the communication lines among the packet exchangers wherein the section for controlling line paths have functions for transmitting messages to the line exchangers to set up lines in accordance with the instructed paths so that the line exchangers receive the messages for controlling and setting the connected lines, set up the communication lines, and send control messages to the line exchangers for setting the lines in accordance with the instructed paths and a cooperative control section having a function for receiving instructions by new communication lines, referring to two pieces of information, connection information, with respect to the packet exchange, collected by the section for controlling line paths, and connection information with respect to the packet exchange collected by the section for controlling packet paths, selecting paths used for the new communication lines, and instructing the section for controlling line paths to set paths used for the new communication lines wherein Open Shortest Path First-Traffic Engineering (OSPF) is used as a communication protocol for

the communication lines (Page 15, Section 6, Pages 13-14, Section 5.2 and Page 9, Figure 1). (If the exterior IP domain is trusted, the edge routers can receive interior routing and link state information from the optical network and may also signal explicit routes through the network via the control domain [Page 15, Section 6, Pages 13-14, Section 5.2]. It is further inherent that the received information concerning the interior state of the optical network is stored, as it is used for explicit route determination at the edge nodes. Finally it is inherent that there exists cooperative control between the IP [i.e. packet exchanger] and MPLS [i.e. path controller] signaling to establish the routes, as the routes are established responsive to demands to access remote IP networks, but are implemented using MPLS label switch establishment commands [Page 15-20, Section 6, Pages 13-14, Section 5.2]. Finally, *Rajagoplan* discloses that OSPF Opaque-LSAs, with the appropriate extensions, may be used to distribute topology information, including topology state information and that RSVP-TE may be used to establish paths within the network [Pages 15-16, Section 6.1.1].)

Therefore, since *Rajagoplan* suggests a combined IP router utilizing OSPF, it would have been obvious to a person of ordinary skill in the art at the time of the invention to implement combined IP and optical signaling into as taught by *Rajagoplan* into the teachings of *Xu.* Combined IP and optical signaling into as taught by *Rajagoplan* can be implemented into the system of *Xu* by moving the optical network control instance from the optical ingress router to the optical edge router as taught by *Rajagoplan* and implementing cooperative IP and MPLS control of routing in the separated packet and control units of *Xu* by means of BGP signaling and OSPF. The motive to combine is provided by *Rajagoplan* and is to allow the IP network to use explicit route signaling if the opposing MPLS network is trusted (Page 15, Section 6, Pages 13-14, Section 5).

Xu fails to disclose an optical network further comprising sections for establishing optical paths using OSPF-TE as a routing protocol. In the same field of endeavor, *Kompella* discloses an optical network further comprising sections for establishing optical paths using OSPF-TE as a routing protocol (Page 3, Abstract and Pages 5). (The system of *Kompella* discloses the use of OSPF-TE in a GMPLS network in order to transmit traffic load information within the network.)

Therefore, since *Kompella* discloses the use of OSPF-TE in a GMPLS network, it would have been obvious to a person of ordinary skill in the art at the time of the invention to combine the OSPF-TE routing protocol of *Kompella* with the system of *Xu* by replacing the OSPF protocol of *Xu* as modified by *Rajagoplan* with OSPF-TE to allow the system to transmit extended LSAs with traffic engineering information in the network. The motive to combine is provided by *Kompella* and is to allow the OSPF routing protocol to carry extended information that enables the use of traffic engineering to improve network utilization and robustness (See Pages 3-4).

Regarding claim 19, *Xu* discloses A packet exchanger (Figure 1, Element A2) in an information transmission network system, having a plurality of line exchangers (Figure 1, Elements X1 and X2) and a plurality of packet exchangers, (Figure 1, Elements A1 and A3) comprising:

a. Line switches, (Figure 1, Elements X5 and X2) connected to the line exchangers, having a function for connecting the communication lines to the line exchangers based on a topology of the communication lines among the packet exchangers (Pages 8-9, Section 6.1.4). (The BNE/packet exchanger obtain information on external IP routes using a routing protocol [i.e. routing information concerning the topology of the communication lines among the edge IP router/packet exchanger and a non-edge IP

router/packet exchanger in an external network] [Page 8, Section 6.1 - For example, looking to Fig. 1 the route to A1 learned by A2 via an IGP/EGP]. The packet exchanger/BNE further uses the routing information gained via the IP network instance in the external network to control routing through the optical network by allowing the system to specify the source and destination of the optical circuit connection to devices in the external IP network [Pages 8-9, Section 6.1.4] [For Example A5 may know the route to the router A1, in the external network, is carried via an optical route terminating at A2 - See [Pages 8-9, Section 6.1.4]. Therefore the OXC/line exchanger, which establishes the optical connection upon request of the BNE/packet exchanger, establishes the optical path based on routes/topologies to external IP routers/packet exchangers learned by the packet exchanger.)

b. A packet switch (Figure 1, Element A2) having function for selecting communication lines used for transmittance, in accordance with packet-ingress-side's information transmitted by the communication lines and outputting the same (Pages 4-7). (Routers A2, A3, A5 and A7 Maintain Standard IP routing tables which determine the routes to the layer 3 neighbors [Page 7, Section 6.1]. These routes are distributed via BGP instances maintained at each IP router via the communication lines [Page 5].)

c. A section for controlling packet paths having functions for acknowledging connection-related-information with respect to packet exchange by exchanging information of the packet paths via the communication lines among the packet exchangers connected via the communication lines, and determining a communication line for output (Page 6). (The client side ingress edge router exchanges IP network reachability information with

the provider side ingress edge router which forewords the information to the other client side ingress routers and vice versa [Page 6].)

d. Wherein the communication lines are Synchronous Optical NETwork/Synchronous Digital Hierarchy (SONET/SDH) lines (Pages 4-7 and 14). (The communications lines used in the system of *Xu* may comprise underlying SONET/SDH transmission paths [See Page 14, LSP Type - "SDH" and "SONET"].)

Xu further discloses a plurality of *optical ingress routers* for setting communication lines among the packet exchangers comprising:

a. At least a section for controlling line paths in the line exchangers, connected to the communication lines among the packet exchangers/line exchangers, for exchanging connection information of the communication lines and acknowledging line connection conditions in a line-exchanging-network network (Pages 7-8 and Page 9, "In provider networks, both...." to end of page). (Intra domain link status information is disseminated using an IGP and stored in all border network entities (BNEs) and non BNEs [Page 9, "In provider networks, both...." to end of page]. Therefore, topology information [including, at a minimum, fiber optic link status] concerning the internal links [including the optic links] is exchanged via an IGP and stored by the border network entity (BNE)/edge router control instance. Finally, upon demand, a path for carrying packets between Client A, Location 1 and Client A, Location 2, is created when the ingress BGP speaker/edge router feeds a signal that establishes the route to the intra-domain routing process

[Figure 1, Connection between A2 and A7 and Page 7, Numbers 7-9]. The path may be set up/torn down on demand [Page 8, Numeral 2].)

b. A cooperative control section having a function for receiving instructions by new communication lines, referring to two pieces of information, connection information, with respect to the packet exchange, collected by the section for controlling line paths, (i.e. internal intra-domain optical routing information) and connection information with respect to the packet exchange collected by the section for controlling packet paths, (i.e. the IP information of the exit edge router) selecting paths used for the new communication lines, and instructing the section for controlling line paths to set paths being used for the new communication lines wherein the section for controlling line paths has functions for transmitting messages to the line exchangers to set up lines in accordance with the instructed path, instructed by the cooperative control section, so that the line exchangers, receive the messages for controlling and setting the connected lines, set up the communication lines, and send control messages to the line exchangers for setting the lines in accordance with the instructed paths wherein the section for controlling line paths has functions for transmitting messages to the line exchangers to set up lines in accordance with the instructed path, instructed by the cooperative control section, so that the line exchangers, receive the messages for controlling and setting the connected lines, set up the communication lines, and send control messages to the line exchangers for setting the lines in accordance with the instructed paths (Pages 4-8). (The provider ingress edge router has an intra-domain routing process that creates the intra domain label switched path based on the interior optical network information [Page 7, Section 8] and the egress edge IP address [Page 7, Section 8]. Therefore, it is inherent that the

instruction to create such a path must include the connection information of the line exchange and the packet path information.)

Xu fails to disclose that the system comprises a single provider network such that the information exchange occurs between all of the optical ingress routers. (i.e. The system of *Xu* discloses the provisioning of GMPLS VPNs in a situation with multiple provider networks. The use of multiple provider networkers breaks up the common exchange of all CAG information among the edge routers, as the provider-to-provider link does not allow the dissemination of the CAG information via a single provider IGP to all edge routers [See Page 6, Section 4.1 Number 4 - The CAP info may be filtered at the provider edge based on service agreements]. The system of *Ould-Brahim* is provided to cure this deficiency by showing that it was known in the art that GMPLS systems with a single provider network could be constructed so as to allow the collapse into a single common provider VPN the example of Fig. 1 of *Xu* such so as to form a contiguous IGP domain allowing the common use and exchange of IGP information among the optical network control instances.) In the same field of endeavor, *Ould-Brahim* discloses that the system comprises a single provider network such that the information exchange occurs between all of the optical ingress routers (See pages 3-4, Section 4).

Therefore, since *Ould-Brahim* suggests the use of a common provider network for performing VPN connections, it would have been obvious to a person of ordinary skill in the art at the time of the invention to collapse the provider network of *Xu* into a single provider domain and to then use the IGP protocol in the optical domain to allow the common use and exchange of IGP information among the optical network control instances. The motive to combine is to allow the techniques of *Xu* to be used to perform VPN networking among multiple clients in a single provider domain.

Xu fails to disclose a plurality a packet/line exchanger in an information transmission network system, having a plurality of line exchangers and a plurality of packet exchangers, for setting communication lines among the packet exchangers, comprising at least a section for controlling line paths in the line exchangers, connected to the communication lines among the packet exchangers/line exchangers, for exchanging connection information of the communication lines and acknowledging line connection conditions in a line-exchanging-network network a cooperative control section having a function for receiving instructions by new communication lines, referring to two pieces of information, connection information, with respect to the packet exchange, collected by the section for controlling line paths, and connection information with respect to the packet exchange collected by the section for controlling packet paths, selecting paths used for the new communication lines, and instructing the section for controlling line paths to set paths being used for the new communication lines wherein the section for controlling line paths has functions for transmitting messages to the line exchangers to set up lines in accordance with the instructed path, instructed by the cooperative control section, so that the line exchangers, receive the messages for controlling and setting the connected lines, set up the communication lines, and send control messages to the line exchangers for setting the lines in accordance with the instructed paths wherein the section for controlling line paths has functions for transmitting messages to the line exchangers to set up lines in accordance with the instructed path, instructed by the cooperative control section, so that the line exchangers, receive the messages for controlling and setting the connected lines, set up the communication lines, and send control messages to the line exchangers for setting the lines in accordance with the instructed paths wherein Open Shortest Path First-Traffic Engineering (OSPF) is used as a communication protocol for the communication lines. In the same field of endeavor, *Rajagoplan* discloses a plurality a packet/line exchanger in an

information transmission network system, having a plurality of line exchangers and a plurality of packet exchangers, for setting communication lines among the packet exchangers, comprising at least a section for controlling line paths in the line exchangers, connected to the communication lines among the packet exchangers/line exchangers, for exchanging connection information of the communication lines and acknowledging line connection conditions in a line-exchanging-network network a cooperative control section having a function for receiving instructions by new communication lines, referring to two pieces of information, connection information, with respect to the packet exchange, collected by the section for controlling line paths, and connection information with respect to the packet exchange collected by the section for controlling packet paths, selecting paths used for the new communication lines, and instructing the section for controlling line paths to set paths being used for the new communication lines wherein the section for controlling line paths has functions for transmitting messages to the line exchangers to set up lines in accordance with the instructed path, instructed by the cooperative control section, so that the line exchangers, receive the messages for controlling and setting the connected lines, set up the communication lines, and send control messages to the line exchangers for setting the lines in accordance with the instructed paths wherein the section for controlling line paths has functions for transmitting messages to the line exchangers to set up lines in accordance with the instructed path, instructed by the cooperative control section, so that the line exchangers, receive the messages for controlling and setting the connected lines, set up the communication lines, and send control messages to the line exchangers for setting the lines in accordance with the instructed paths wherein Open Shortest Path First-Traffic Engineering (OSPF) is used as a communication protocol for the communication lines (Page 15, Section 6, Pages 13-14, Section 5.2 and Page 9, Figure 1). (If the exterior IP domain is trusted, the edge routers can receive interior routing and link state

information from the optical network and may also signal explicit routes through the network via the control domain [Page 15, Section 6, Pages 13-14, Section 5.2]. It is further inherent that the received information concerning the interior state of the optical network is stored, as it is used for explicit route determination at the edge nodes. Finally it is inherent that there exists cooperative control between the IP [i.e. packet exchanger] and MPLS [i.e. path controller] signaling to establish the routes, as the routes are established responsive to demands to access remote IP networks, but are implemented using MPLS label switch establishment commands [Page 15, Section 6, Pages 13-14, Section 5.2]. Finally, *Rajagoplan* discloses that OSPF Opaque-LSAs, with the appropriate extensions, may be used to distribute topology information, including topology state information and that RSVP-TE may be used to establish paths within the network [Pages 15-16, Section 6.1.1].)

Therefore, since *Rajagoplan* suggests a combined IP router utilizing OSPF, it would have been obvious to a person of ordinary skill in the art at the time of the invention to implement combined IP and optical signaling into as taught by *Rajagoplan* into the teachings of *Xu*. Combined IP and optical signaling into as taught by *Rajagoplan* can be implemented into the system of *Xu* by moving the optical network control instance from the optical ingress router to the optical edge router as taught by *Rajagoplan* and implementing cooperative IP and MPLS control of routing in the separated packet and control units of *Xu* by means of BGP signaling and OSPF. The motive to combine is provided by *Rajagoplan* and is to allow the IP network to use explicit route signaling if the opposing MPLS network is trusted (Page 15, Section 6, Pages 13-14, Section 5).

Xu fails to disclose an optical network further comprising sections for establishing optical paths using OSPF-TE as a routing protocol. In the same field of endeavor, *Kompella* discloses an optical network further comprising sections for establishing optical paths using OSPF-TE as

a routing protocol (Page 3, Abstract and Pages 5). (The system of *Kompella* discloses the use of OSPF-TE in a GMPLS network in order to transmit traffic load information within the network.)

Therefore, since *Kompella* discloses the use of OSPF-TE in a GMPLS network, it would have been obvious to a person of ordinary skill in the art at the time of the invention to combine the OSPF-TE routing protocol of *Kompella* with the system of *Xu* by replacing the OSPF protocol of *Xu* as modified by *Rajagoplan* with OSPF-TE to allow the system to transmit extended LSAs with traffic engineering information in the network. The motive to combine is provided by *Kompella* and is to allow the OSPF routing protocol to carry extended information that enables the use of traffic engineering to improve network utilization and robustness (See Pages 3-4).

6. **Claim 5** is rejected under 35 U.S.C. 103(a) as being unpatentable over X*u*, et al. (Y. Xu, A. Basu and Y. Xue, IETF Draft, June 2002, A BGP/GMPLS Solution for Inter-Domain Optical Networking) in view of *Ould-Brahim*, et al. (H. Ould-Brahim, Y. Rekhter, D. Fedyk, E. Rosen, E. Mannie, L. Fang, J. Drake, Y. Xue, R. Hartani and D. Papadimitrio, BGP/GMPLS Optical/TDM VPNs, IETF Draft, November 2001, Pages 1-18), *Rajagoplan,* et al. (B. Rajagoplan, J. Liciani, D. Aduche, B. Cain, B. Jamoussi and D. Saha, IP over Optical Networks: A Framework – Second Draft Version, 6 June 2002, Internet Engineering Task Force, Pages 1-41), *Kompella* (K. Kompella, J. Drake, G. Bernstein, D. Fedyk, E. Mannie, D. Saha, and V. Sharma, OSPF Extensions in Support of Generalized MPLS, Network Working Group- Internet draft: draft-kompella-ospf-gmpls-extensions-02, July 2001, Pages 1-9), *Jagannath* (US Patent No. 6,483,833 B1) and *Francisco*, et al. (Mark Joseph Francisco, Stephen Simpson, Lambros Pezoulas, Changcheng Huang, Ioannis Lambadaris, Interdomain Routing In Optical Networks, Proceedings of SPIE Opticomm, August 2001, Pages 1-10).

Regarding claim 5, X*u* discloses a computer program, embedded in a non-transitory computer readable medium, used for optical networks and optical edge routers (Figure 1, A2 and B2 and Page 5) having sections for predetermined calculations (Page 6 – It is inherent that the client edge routers calculate predetermined forwarding tables) and sections for transmitting packets between the sections for predetermined calculations and external IP networks, (Fig. 1, Connection between A2 and A1) wherein the section for the predetermined calculations comprises functions of:

a. Exchanging route information between neighboring routers in external IP networks (Page 8, Section 6.1). (The BNE obtains information on external IP routes to neighboring routers using a routing protocol [Page 8, Section 6.1 - For example, looking to Fig. 1 the route to A1 learned by A2 via an IGP/EGP].)

b. Producing a routing table and storing the produced routing table in a storage section (Page 8, Section 6.1). (The BNE is responsible for carrying out routing functions to neighboring IP routers, which inherently requires use of a routing table [Page 8, Section 6.1].)

c. Controlling switching of the optical paths based on at least one of topology and routing information in the storage section regarding the external IP networks (Pages 8-9, Section 6.1.4). (The packet exchanger/BNE further uses the routing information gained via the IP route information exchange with the router in the external network to control routing through the optical network by allowing the system to specify the source and

destination of the optical circuit connection to devices in the external IP network [Pages 8-9, Section 6.1.4] [For Example A5 may know the route to the router A1, learned via the exchanging of route information between A1 and A2 in the external network, is carried via an optical route terminating at A2 - See [Pages 8-9, Section 6.1.4].)

d. Signaling so as to establish and release optical paths (Page 3, Section 3). (The system of *Xu* discloses a system for establishing and tearing down optical LSPs [Page 3, Section 3].)

e. Notifying route information to other optical edge routers which face the optical edge router (Pages 8-9, Section 6.4.1). (The system of *Xu* discloses that the BNE obtains information on routes to external IP routers and stores the information in a routing table [Page 8, Section 6.1][See also (a) and (b), Supra]. This information may be shared with other BNEs to enable end-to-eng routing and determination of specific optical start and endpoints through the network [Pages 8-9, Section 6.1.4].)

f. Wherein the optical paths are wavelength paths (Pages 13-14). (The path type may be a lambda [i.e. wavelength] path [Page 14, Encoding type "Lambda"].)

X*u* further discloses an *optical ingress router* having a section for predetermined calculations further comprising the functions of:

a. Collecting topology information inside the optical network and storing the collected topology information (Page 9) (The BNEs in the provider domain exchange and store link state information [Page 9].)

b. Signaling so as to establish and release optical paths (Page 3, Section 3). (The system of *Xu* discloses a system for establishing and tearing down optical LSPs [Page 3, Section 3].)

c. Reading out the topology information from the storage section and producing a packet forwarding table which sets where the packets are to be transmitted by the section for transmitting packets (Pages 5-6). (The optical edge router [i.e. X1] determines the internal routing of the optical network and routes packets, inherently requiring a packet forwarding table [Pages 5-6]).

Finally, *Xu* discloses a system wherein

a. The function of exchanging the route information and the function of producing the routing table provide an IP network instance of the optical edge router (Routers A2, A3, A5 and A7 Maintain Standard IP routing tables which determine the routes to the layer 3 neighbors [Page 8, Section 6.1]. The routes may be those of the external IP neighbors learned via an IGP/EGP [Page 8, Section 6.1][i.e. For example, looking to Fig. 1 the route to A1 learned by A2 via an IGP/EGP].)

b. The function of controlling the switching, the function of collecting the topology information, the function of signaling, and the function of notifying the route information provide an optical network control instance of the *optical ingress router.*

c. The optical network control instance is provided so as to be used by all the external IP networks *in a provider network* (Page 6, Section 4.1, Numbers 2 and 5 and Pages 16-17, Section 7.4). (The optical network control instances in the BNE/optical edge routers within a single provider IGP domain exchange all CAG information for all client networks among themselves, regardless of attachment to the client network [Pages 17-18, Section 7.6]. Therefore, the optical network control instance is used by all the external IP networks.)

d. Wherein the IP network instance is provided independent of IP network instances of the other optical edge routers corresponding to other external IP networks (Page 6, Section 4.1, Number 5 and Pages 16-17, Section 7.4). (The IP network instances are "provided independent of each other", as the IP network control instances only receive routes to external IP network from the other IP network Instances if they are members of the same client network [Page 6, Section 4.1, Number 5 and Pages 16-17, Section 7.4 - Showing that “client B” will not receive information from client A's IP network instances] [See also Applicant’s Specification, Pages 30-31 - showing that what is meant by an "independent" IP network instance is that each instance is independent of other instances associated with another client networks, as it does not exchange routing information with the other client networks].)

Xu fails to disclose in a single embodiment that the system comprises a single provider network such that the optical network control instances are provided so as to be used by all the external IP networks (i.e. The system of *Xu* discloses the provisioning of GMPLS VPNs in a situation with multiple provider networks. The use of multiple provider networkers breaks up the common exchange of all CAG information among the edge routers, as the provider-to-provider link does not allow the dissemination of the CAG information via a single provider IGP to all edge routers [See Page 6, Section 4.1 Number 4 - The CAP info may be filtered at the provider edge based on service agreements]. The system of *Ould-Brahim* is provided to cure this deficiency by showing that it was known in the art that GMPLS systems with a single provider network could be constructed so as to allow the collapse into a single common provider VPN the example of Fig. 1 of *Xu* such so as to form a contiguous IGP domain allowing the common use and exchange of IGP information among the optical network control instances.) In the same field of endeavor, *Ould-Brahim* discloses the use of a common provide network to link multiple customer VPN sites (See pages 3-4, Section 4).

Therefore, since *Ould-Brahim* suggests the use of a common provider network for performing VPN connections, it would have been obvious to a person of ordinary skill in the art at the time of the invention to collapse the provider network of *Xu* into a single provider domain and to then use the IGP protocol in the optical domain to allow the common use and exchange of IGP information among the optical network control instances. The motive to combine is to allow the techniques of *Xu* to be used to perform VPN networking among multiple clients in a single provider domain.

Xu fails to disclose the use of OSPF for collecting information in the optical domain or the inclusion of the functionality of the optical ingress router in the optical edge router such that the section for predetermined calculations in the optical ingress router further comprises the

functions of collecting topology information inside the optical networks and storing the collected topology information in the storage section using Open Shortest Path First- Traffic Engineering (OSPF-TE) as a routing protocol. In the same field of endeavor, *Rajagoplan* discloses the use of OSPF for collecting information in the optical domain and the inclusion of the functionality of the optical ingress router in the optical edge router such that the section for predetermined calculations in the optical ingress router further comprises the functions of collecting topology information inside the optical networks and storing the collected topology information in the storage section using Open Shortest Path First- Traffic Engineering (OSPF-TE) as a routing protocol (Page 15, Section 6, Pages 13-14, Section 5.2 and Page 9, Figure 1). (If the exterior IP domain is trusted, the edge routers can receive interior routing and link state information from the optical network and may also signal explicit routes through the network via the control domain [Page 15, Section 6, Pages 13-14, Section 5.2]. It is further inherent that the received information concerning the interior state of the optical network is stored, as it is used for explicit route determination at the edge nodes. Finally it is inherent that there exists cooperative control between the IP [i.e. packet exchanger] and MPLS [i.e. path controller] signaling to establish the routes, as the routes are established responsive to demands to access remote IP networks, but are implemented using MPLS label switch establishment commands [Page 15-20, Section 6 and Pages 13-14, Section 5.2]. Finally, *Rajagoplan* discloses that OSPF Opaque-LSAs, with the appropriate extensions, may be used to distribute topology information, including topology state information and that RSVP-TE may be used to establish paths within the network [Pages 15-16, Section 6.1.1].)

Therefore, since *Rajagoplan* suggests a combined IP router utilizing OSPF, it would have been obvious to a person of ordinary skill in the art at the time of the invention to implement combined IP and optical signaling into as taught by *Rajagoplan* into the teachings of

Xu. Combined IP and optical signaling into as taught by *Rajagoplan* can be implemented into the system of *Xu* by moving the optical network control instance from the optical ingress router to the optical edge router as taught by *Rajagoplan* and implementing cooperative IP and MPLS control of routing in the separated packet and control units of *Xu* by means of BGP signaling and OSPF. The motive to combine is provided by *Rajagoplan* and is to allow the IP network to use explicit route signaling if the opposing MPLS network is trusted (Page 15, Section 6, Pages 13-14, Section 5).

Xu fails to disclose a router comprising a section for collecting topology information using OSPF-TE as a routing protocol. In the same field of endeavor, *Kompella* discloses a router comprising a section for collecting topology information using OSPF-TE as a routing protocol (Page 3, Abstract and Pages 5). (The system of *Kompella* discloses the use of OSPF-TE in a GMPLS network in order to transmit traffic load information within the network.)

Therefore, since *Kompella* discloses the use of OSPF-TE in a GMPLS network, it would have been obvious to a person of ordinary skill in the art at the time of the invention to combine the OSPF-TE routing protocol of *Kompella* with the system of *Xu* by replacing the OSPF protocol of *Xu* as modified by *Rajagoplan* with OSPF-TE to allow the system to transmit extended LSAs with traffic engineering information in the network. The motive to combine is provided by *Kompella* and is to allow the OSPF routing protocol to carry extended information that enables the use of traffic engineering to improve network utilization and robustness (See Pages 3-4).

Xu as modified by *Rajagoplan* and *Kompella* fails to disclose reading out the routing tables and the topology information from the storage sections and producing a packet forwarding table which sets where the packets are to be transmitted to by the section for transmitting the packets (i.e. The system of *Xu* discloses that the optical ingress router/client

BNE establishes routes based on the "routing tables" [i.e. topology information of the external IP networks] and uses this information to control the routing to and from the optical domain by selecting appropriate optical endpoints in the network. Therefore, the routing of packets to and from the optical domain is based on both the routing information of the external IP network and the topology information of the optical network. The modification of *Rajagoplan* allows the optical ingress router to gather and store topology information of the optical network via OSPF. Therefore the system of *Xu* as modified by *Rajagoplan* discloses the optical ingress router stores both "routing tables" to the external network and topology information of the optical network and uses this information to forward packets to and from the external IP networks. What is not disclosed is the explicit formation of a routing table for linking the optical/MPLS and the external IP domain. This deficiency is cured by *Jagannath* which discloses the use of a table linking the GMPLS/optical and IP domains.) In the same field of endeavor, *Jagannath* discloses reading out the routing tables and the topology information from the storage sections and producing a packet forwarding table which sets where the packets are to be transmitted to by the section for transmitting the packets (Column 4, Lines 50-67).

Therefore, since *Jagannath* discloses the use of a routing and label table, it would have been obvious to a person of ordinary skill in the art to use the routing and label tables of *Jagannath* in the system of *Xu*. The routing and label tables of *Jagannath* can be combined with the system of *Xu* by implementing a routing table based on received routing information and implementing a label table based on the routing table and the allocated label switched paths as taught by *Jagannath*. The motive to combine is to allow the connection of specific IP addresses to labels.

The system of *Xu* fails to disclose signaling so as to establish/release the optical paths using Border Gateway Protocol (BGP). In the same field of endeavor, *Francisco* discloses

signaling so as to establish/release the optical paths using Border Gateway Protocol (BGP) (Introduction Pages 1-2). (The system of *Francisco* discloses the use of BGP for establishing and releasing optical paths in an optical domain [Introduction, Pages 1-2].)

Therefore, since *Francisco* suggests the use of BGP for establishing interdomain paths in optical networks, it would have been obvious to a person of ordinary skill in the art at the time of the invention to implement the optical BGP signaling of *Francisco* into the teachings of *Xu* by establishing optical paths using BGP signaling. The motive to combine is provided by *Francisco* and is to re-use the widely deployed BGP protocol to enable end-to-end lightpath connections (Pages 1-2, Introduction) and also by *Rajagoplan,* which suggests that the use of BGP for establishing end-to-end lightpaths should be explored (Section 7.7.2, Page 31).

7. **Claims 6 and 12** are rejected under 35 U.S.C. 103(a) as being unpatentable over *Rosen*, et al. (E. Rosen, A. Viswanathan and R. Callon, Multiprotocol Label Switching Architecture, Internet Engineering Task Force, July 2000) in view of *Sasagawa* (US Patent No. 7,336,648 B1), X*u*, et al. (Y. Xu, A. Basu and Y. Xue, IETF Draft, June 2002, A BGP/GMPLS Solution for Inter-Domain Optical Networking) and *Braun*, et al. (Braun, Guenter, and Khalil, Management of quality of service enabled VPNs, Communications Magazine, IEEE , vol.39, no.5, pp.90-98, May 2001).

Regarding claim 6, *Rosen* discloses a cutting-through method (Page 20- See (a), infra) for direct communication by a plurality of edge routers for connecting a core network and a plurality of external IP networks mutually at border points of the core network and the external IP networks, (Pages 4-6) comprising:

a. Maintaining lists, in which ingress-side IP address correspond to identifiers for showing egress edge routers, in ingress edge routers (Pages 4-6 and Page 20). (The network of *Rosen* discloses an Ingress Edger router which maps IP addresses (i.e. FEC's) to specific label switched paths, which serve to identify the outgoing egress label router of the MPLS network [Pages 4-6]. Such mapping is done by means of a routing table, which matches IP address ranges [i.e. FEC's] to label switched paths [Page 5]. The paths are then routed through the MPLS network to a corresponding egress edger router connected to another IP domain, where the label is removed and the packet forwarded using its IP address [Pages 4-6].)

b. Adding the identifiers corresponding to the ingress-side IP address to the IP packets by the ingress edge routers when IP packets are transmitted (Pages 4-6 and 20). (The label for the LSP is added at the ingress edge router - See also (a), Supra).

c. Transmitting the IP packets to the outgoing interfaces by referring to the identifiers added to the IP packets in the egress edge routers wherein Multi-Protocol Label Switching (MPLS) labels are used for the identifiers (Pages 4-6 and 20 - See (a), Supra).

d. Wherein the optical paths are wavelength paths (Pages 13-14). (The path type may be a lambda [i.e. wavelength] path [Page 14, Encoding type "Lambda"].)

Rosen fails to disclose maintaining a relationship between identifiers and outgoing interfaces in the egress edge routers and retrieving the outgoing interfaces corresponding to the identifiers added to the IP packets by using the added identifiers as a key in the egress edge

routers and transmitting the IP packets to the retrieved outgoing interfaces (Column 1, Lines 1-32). (*Sasagawa* discloses that an egress-side label switch router may be broken into several "logical" label switch routers (LSRs) which appear to outside LSRs [including ingress LSRs] as independent label switch routers [Column 8, Line 52 to Column 9, 9, Line 18]. The purpose of the “logical” LSRs is to allow other routers to precisely specify the egress port to which a LSP is to terminate when establishing the LSP path [Column 7, Lines 44-50 and Column 11, Line 42 to Column 12, Line 52, Particularly Column 12, Lines 17-52, See also Claim 1-4]. Each of the “logical” LSRs stores a MPLS routing table in which the incoming label is associated with an outgoing port [Column 1, Lines 23-31, Column 3, Lines 35-47, Column 9, Lines 61-67 and Fig. 9, Element 20).

Therefore, since *Sasagawa* suggests the use of egress port specific LSPs in which the correspondence of the LSP and the egress port is stored the egress edge router and is used to switch the labeled packet, it would have been obvious to a person of ordinary skill in the art at the time of the invention to combine the egress port specific LSPs of *Sasagawa* with the system of *Rosen* by establishing and forwarding LSPs to specific output ports on the egress edge routers via tables at the egress routers specifying the outgoing ports. The motive to combine is provided by *Sasagawa* and is to avoid the inefficiency of having to use IP to route packets to the output port of the edge router and to allow for the use of sophisticated traffic engineering techniques (Column 1, Lines 59-67, Column 4, Lines 13-20 and Column 7, Lines 43-50).

Rosen fails to disclose the core network is a GMPLS network wherein Generalized Multi-Protocol Label Switching (GMPLS) labels are used for the identifiers and controlling switching of optical paths in the core network based on at least one of topology and routing information in the maintained lists regarding the external IP network, wherein the core network and the external IP networks are optical networks in which edge routers are connected directly by

optical paths. In the same field of endeavor, *Xu* discloses the core network is a GMPLS network wherein Generalized Multi-Protocol Label Switching (GMPLS) labels are used for the identifiers and controlling switching of optical paths in the core network based on at least one of topology and routing information in the maintained lists regarding the external IP network, wherein the core network and the external IP networks are optical networks in which edge routers are connected directly by optical paths (Fig. 1 and Page 3, Section 3). (*Xu* discloses a network where the core provider and the client networks are connected by optical paths [Fig. 1]. *Xu* further disclose the use of GMPLS as an extension to MPLS so that core networks utilizing optical connections may operate using the MPLS protocol [Page 3, Section 3]. Finally, *Xu* discloses that the paths through the optical network may be controlled based on external network IP topology information [Pages 8-9, Section 6.1.4]. The packet exchanger/BNE further uses the routing information gained via the IP route information exchange with the router in the external network to control routing through the optical network by allowing the system to specify the source and destination of the optical circuit connection to devices in the external IP network [Pages 8-9, Section 6.1.4] [For Example A5 may know the route to the router A1, learned via the exchanging of route information between A1 and A2 in the external network, is carried via an optical route terminating at A2 - See [Pages 8-9, Section 6.1.4].)

Therefore, since *Xu* suggests the use of a GMPLS network that maintains topology information concerning the LSP termination points of specific external IP routes on remote edge routers and *Rosen* as modified by *Sasagawa* suggests that the termination points of LSPs may be on the outgoing, as opposed to incoming, ports of the routers, a person of ordinary skill in the art would have combined the system of *Xu* with the system of *Rosen* as modified by *Sasagawa* by allowing the optical ingress and egress edge routers to track and establish optical MPLS LSPs to specific external IP addresses associated with the outgoing ports of other optical edge

routers. The motive to combine is provided by *Xu* and is to allow the system to use IP network engineering to precisely determine the source and destination of the optical LSPs (Pages 8-9, Section 6.1.4).

Put another way, the system of *Rosen* as modified by *Sasagawa* teaches a base system in which MPLS label switched paths are allowed to terminate on the outgoing, as opposed to incoming ports of MPLS routers and the system of *Xu* teaches a known improvement to MPLS systems, GMPLS, with an extension to allows edge ingress and egress routers to store information concerning the complete end-to-end optical path to an external IP network terminating at a remote edge router. Therefore, a person of ordinary skill could have applied the GMPLS routing with end-to-end routing to the system of *Rosen* as modified by *Sasagawa* by using GMPLS in the system of *Rosen* as modified by *Sasagawa* by storing the routing information concerning the endpoints terminating on the outputs of the ingress and egress edge routers of *Rosen* as modified by *Sasagawa* in accordance with the improvements taught by *Xu* to produce the predictable result of a system that stores information relating external IP networks to outgoing interfaces of edge routers in each edge router, in view of the use of this teaching for improving other MPLS systems.

Rosen fails to disclose a cutting-through method wherein correspondence information with respect to the ingress-side IP address and its corresponding identifiers are exchanged among the edge routers by control signals. In the same field of endeavor, *Braun* discloses a cutting-through method wherein correspondence information with respect to the ingress-side IP address and its corresponding identifiers are exchanged among the edge routers by control signals (Page 92, “Multiprotocol Label Switching” - The labels and IP addresses associated with LSPs are exchanged between the edge routers.)

Therefore, since *Braun* discloses the use of label and IP distribution, it would have been obvious to a person of ordinary skill in the art at the time of the invention to implement the label and IP distribution of *Braun* into the teachings of *Rosen*. The label and IP distribution of *Braun* can be implemented into the system of *Rosen* by distributing labels and associated IP information from the egress edge router to the ingress edge router as taught by *Braun*. The motive to combine is to allow the egress edge routers of *Rosen* to communicate network information concerning the established label paths, thereby allowing communication of reachability information between the edge routers.

Regarding claim 12, *Rosen* discloses a computer program embedded in a non-transitory computer readable medium, installed to an information processing apparatus, (It is inherent that the routers of *Rosen* included processors) for realizing functions corresponding to edge routers, the functions being inputting functions, for connecting a core network and a plurality of external IP networks at border points mutually and handling incoming IP packets inputted from the external IP networks to the core network and outputting functions, for handling outgoing IP packets outputted from the core network to the external IP networks, wherein, the inputting functions serve for (Pages 4-6 and 20 - See also claim 6, Supra):

a. A function for maintaining lists in which ingress-side IP addresses correspond to identifiers for showing other egress edge routers. (Pages 4-6 and Page 20). (The network of *Rosen* discloses an Ingress Edger router which maps IP addresses (i.e. FEC's) to specific label switched paths, which serve to identify the outgoing egress label router of the MPLS network [Pages 4-6]. Such mapping is done by means of a routing table, which matches IP address ranges [i.e. FEC's] to label switched paths [Page 5]. The paths are then routed through the MPLS network to a corresponding egress edger

router connected to another IP domain, where the label is removed and the packet forwarded using its IP address [Pages 4-6].)

b. A function for adding the identifiers corresponding to the ingress-side IP addresses of the IP packets to the IP packets in accordance with the lists when the IP packets are transmitted to other edge routers, and the outputting function serves for referring to the identifiers and transmitting the IP packets, indicated by the identifiers, to the outgoing interfaces wherein Multi-Protocol Label Switching (MPLS) labels are used for the identifiers (Pages 4-6 and page 20 – See (a), Supra).

c. Wherein the optical paths are wavelength paths (Pages 13-14). (The path type may be a lambda [i.e. wavelength] path [Page 14, Encoding type “Lambda”].)

Rosen fails to disclose the outputting function serves to maintain a relationship between identifiers and outgoing interfaces, retrieve the outgoing interfaces corresponding to the identifiers added to the IP packets by using the added identifiers as a key, and transmit the IP packets, indicated by the identifiers, to the retrieved outgoing interfaces, wherein Multi-Protocol Label Switching (MPLS) labels are used for the identifiers. In the same field of endeavor, *Sasagawa* discloses the outputting function serves to maintain a relationship between identifiers and outgoing interfaces, retrieve the outgoing interfaces corresponding to the identifiers added to the IP packets by using the added identifiers as a key, and transmit the IP packets, indicated by the identifiers, to the retrieved outgoing interfaces, wherein Multi-Protocol Label Switching (MPLS) labels are used for the identifiers(Column 1, Lines 1-32). (*Sasagawa* discloses that an egress-side label switch router may be broken into several "logical" label switch routers (LSRs)

which appear to outside LSRs [including ingress LSRs] as independent label switch routers [Column 8, Line 52 to Column 9, 9, Line 18]. The purpose of the "logical" LSRs is to allow other routers to precisely specify the egress port to which a LSP is to terminate when establishing the LSP path [Column 7, Lines 44-50 and Column 11, Line 42 to Column 12, Line 52, Particularly Column 12, Lines 17-52, See also Claim 1-4]. Each of the "logical" LSRs stores a MPLS routing table in which the incoming label is associated with an outgoing port [Column 1, Lines 23-31, Column 3, Lines 35-47, Column 9, Lines 61-67 and Fig. 9, Element 20).

Therefore, since *Sasagawa* suggests the use of egress port specific LSPs in which the correspondence of the LSP and the egress port is stored the egress edge router and is used to switch the labeled packet, it would have been obvious to a person of ordinary skill in the art at the time of the invention to combine the egress port specific LSPs of *Sasagawa* with the system of *Rosen* by establishing and forwarding LSPs to specific output ports on the egress edge routers via tables at the egress routers specifying the outgoing ports. The motive to combine is provided by *Sasagawa* and is to avoid the inefficiency of having to use IP to route packets to the output port of the edge router and to allow for the use of sophisticated traffic engineering techniques (Column 1, Lines 59-67, Column 4, Lines 13-20 and Column 7, Lines 43-50).

Rosen fails to disclose the core networks and the external IP networks are optical networks in which edge routers are connected directly by optical paths, further comprising a function for controlling the optical paths in the core network based on at least one of topology and routing information in the maintained lists regarding the external IP networks. In the same field of endeavor, *Xu* discloses the core networks and the external IP networks are optical networks in which edge routers are connected directly by optical paths, further comprising a function for controlling the optical paths in the core network based on at least one of topology and routing information in the maintained lists regarding the external IP networks (Fig. 1 and

Page 3, Section 3). (*Xu* discloses a network where the core provider and the client networks are connected by optical paths [Fig. 1]. *Xu* further disclose the use of GMPLS as an extension to MPLS so that core networks utilizing optical connections may operate using the MPLS protocol [Page 3, Section 3]. Finally, *Xu* discloses that the paths through the optical network may be controlled based on external network IP topology information [Pages 8-9, Section 6.1.4]. The packet exchanger/BNE further uses the routing information gained via the IP route information exchange with the router in the external network to control routing through the optical network by allowing the system to specify the source and destination of the optical circuit connection to devices in the external IP network [Pages 8-9, Section 6.1.4] [For Example A5 may know the route to the router A1, learned via the exchanging of route information between A1 and A2 in the external network, is carried via an optical route terminating at A2 - See [Pages 8-9, Section 6.1.4].)

Therefore, since *Xu* suggests the use of a GMPLS network that maintains topology information concerning the LSP termination points of specific external IP routes on remote edge routers and *Rosen* as modified by *Sasagawa* suggests that the termination points of LSPs may be on the outgoing, as opposed to incoming, ports of the routers, a person of ordinary skill in the art would have combined the system of *Xu* with the system of *Rosen* as modified by *Sasagawa* by allowing the optical edge routers to track and establish optical MPLS LSPs to specific external IP addresses associated with the outgoing ports of other optical edge routers. The motive to combine is provided by *Xu* and is to allow the system to use IP network engineering to precisely determine the source and destination of the optical LSPs (Pages 8-9, Section 6.1.4).

Put another way, the system of *Rosen* as modified by *Sasagawa* teaches a base system in which MPLS label switched paths are allowed to terminate on the outgoing, as opposed to incoming ports of MPLS routers and the system of *Xu* teaches a known improvement to MPLS

systems, GMPLS, with an extension to allows edge ingress routers to store information concerning the complete end-to-end optical path to an external IP network terminating at a remote edge router. Therefore, a person of ordinary skill could have applied the GMPLS routing with end-to-end routing to the system of *Rosen* as modified by *Sasagawa* by using GMPLS in the system of *Rosen* as modified by *Sasagawa* and by storing the routing information concerning the endpoints terminating on the outputs of the edge router of *Rosen* as modified by *Sasagawa* in accordance with the improvements taught by *Xu* to produce the predictable result of a system that stores information relating external IP networks to outgoing interfaces of edge routers in each edge router, in view of the use of this teaching for improving other MPLS systems.

Rosen fails to disclose a program according further comprising a function for exchanging information, in which the ingress-side IP addresses correspond to the identifiers, among other edge routers mutually by control signals, and wherein the function for maintaining the lists serves for generating or updating the lists in accordance with the information obtained by the exchanging section with respect to the correspondence information between the ingress-side IP addresses and the identifiers. In the same field of endeavor, *Braun* discloses a program according further comprising a function for exchanging information, in which the ingress-side IP addresses correspond to the identifiers, among other edge routers mutually by control signals, and wherein the function for maintaining the lists serves for generating or updating the lists in accordance with the information obtained by the exchanging section with respect to the correspondence information between the ingress-side IP addresses and the identifiers (Page 92, "Multiprotocol Label Switching" - The labels and IP addresses associated with LSPs are exchanged between the edge routers and the label paths are updated appropriately.)

Therefore, since *Braun* discloses the use of label and IP distribution, it would have been obvious to a person of ordinary skill in the art at the time of the invention to implement the label and IP distribution of *Braun* into the teachings of *Rosen*. The label and IP distribution of *Braun* can be implemented into the system of *Rosen* by distributing labels and associated IP information from the egress edge router to the ingress edge router as taught by *Braun*. The motive to combine is to allow the egress edge routers of *Rosen* to communicate network information concerning the established label paths, thereby allowing communication of reachability information between the edge routers.

Response to Arguments

9. Applicant's arguments with respect to claims 1, 5 and 12 have been considered but are moot in view of the new ground(s) of rejection.

10. Applicant's arguments, see Applicant's Arguments and Remarks, filed 2 March 2011, with respect to claim 15 have been fully considered and are persuasive in view of the cancellation of the claim. The previous ground of rejection has been withdrawn.

11. A portion of Applicant's arguments, see Applicant's Arguments and Remarks, filed 2 March 2011, with respect to the rejection(s) of claim(s) 16-19 under 35 USC 103(a) have been fully considered and are persuasive. Therefore, the rejection has been withdrawn. However, upon further consideration, a new ground(s) of rejection is made in view of *Ould-Brahim*.

Applicant's Arguments that *Xu* may not necessarily store information about operations outside of a provider network and therefore teaches away from the "information exchange" between providers outside the same provider domain has been considered and is persuasive. Therefore, the system of *Ould-Brahim* is now provided to show that the system of *Xu* could be simplified to treat only a single provider network, such that all of the provider edge routers/BNEs/packet exchangers could be connected to the same provider network and perform the "information exchange" freely.

12. The remainder of Applicant's arguments filed 2 March 2011, with respect to claims 16, 18 and 19 have been fully considered but they are not persuasive.

With respect to Applicant's arguments that *Xu* fails to disclose a cooperative control section as required by the claimed invention, as the cooperative control section disclosed in *Xu* is obtained in the client side IP egress edge router and is therefore not a part of the "packet exchanger" (i.e. provider side ingress edge router) (See Applicant's Arguments and Remarks on Pages 16-19) Applicant's Arguments have been considered and are not persuasive.

Most of Applicant's arguments on pages 16-19 appear to be based on a misunderstanding of what comprises the "packet exchanger" and the "line exchanger" in the rejection of the claims. The rejection of claims 16-19, supra, first defines an "optical ingress router" and demonstrates that the functionality of this router is consistent with that of the claimed "cooperative control section". The system of *Rajagoplan* is then used to demonstrate that the "optical ingress router" of *Xu* may perform a host of "packet exchanging" functions. The Applicant apparently argues that since this section carries out IP/Packet Exchanging

functionality, it cannot also participate in the internal MPLS domain and therefore cannot have a "line controlling section" for signaling and exchanging route information in the MPLS domain. However, in view of the teachings of *Rajagoplan* showing exactly such a combination [See the rejection of claims 16-19, supra], this argument is unpersuasive, as a person of ordinary skill in the art would have recognized that a "packet exchanger" with IP functionality could also contain a cooperative control section for performing signing to set up internal MPLS router and would have known that the optical network control instance the optical ingress edge router of *Xu* could be moved to and combined with the ingress edge router functionality of *Xu*, in view of the teachings of a combined IP and MPLS ingress edge router in the system of *Rajagoplan* (See claims 16-19, Supra).

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Christopher Crutchfield whose telephone number is (571) 270-3989. The examiner can normally be reached on Monday through Friday 8:00 AM to 5:00 PM EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Daniel Ryman can be reached on (571) 272-3152. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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